IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	:	10/681,497
Applicant	:	Stephen G. Bales
Filing Date	:	October 27, 2003
Title	:	Lignocellulosic, Borate Filled, Thermoplastic Composites
Examiner:		Matthew J. Daniels
Art Unit	:	1732
Docket No.	:	LA 001
Customer No.		000048373

Declaration Under 37 CFR 1.131

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Stephen G. Bales, declare that all the statements made of my own knowledge are true, and that all statements made on information and belief are believed to be true:

1. In October, 1999 I conceived the use of calcium borate as a fungicide in lignocellulosic composites, also commonly known as wood composites (WC's). Based on further investigation, I then conceived of using CB as a fungicide in lignocellulosic thermoplastic composites, commonly known as wood-plastic composites (WPC's), in July, 2000.

1.131 (continued)

2. By October, 2000 an arrangement had been made for WPC samples containing calcium borate to be prepared for testing. In May, 2001 the initial samples had been prepared and placed in Ohio and Florida test sites. In October, 2001 additional WPC samples containing calcium borate were prepared and placed in these test locations.

3. As a result of testing a range of additive loadings, the discovery was made that calcium borate is an effective WPC fungicide. Further, the surprising discovery was made that CB at loadings as low as 2% increases WPC resistance to surface impairment caused by mold growth. This also addressed a long felt need as described in my declaration under 37 CFR 1.132 dated Nov. 22, 2005.

4. I acknowledge that willful false statements and the like are punishable by fine and/or imprisonment, and may jeopardize the validity of the application of any patent issuing therefrom.

17 Hart Lane, Sewell, NJ 08080

Sworn in the State of New Jersey, County of Gloucester

In the State of New Jersey, this 17 day of June, 2006

Witness my hand and official seal.

My Commission Expires: 14 July 2009

Notary Public

GABRIELE S. MASTROBUONO
Notary Public - New Jersey
My Commission Expires July 14, 2009 of 2

zinc borate (Firebreak ZB) EPA Pesticide Fact Sheet 10/91

AMENDED VERSION: 10/1/91 EPA Pesticide Fact Sheet

Name of Chemical: Zinc Borate (2ZnO.3B2O3.3.5H2O)
Reason for Issuance: New Chemical Registration (AMENDED VERSION)
Date Issued: 7/15/91
Fact Sheet Number: 225.1

1. DESCRIPTION

- Generic Names: Zinc Borate (2ZnO.3B2O3.3.5H2O)
- Trade Name: Firebrake ZB
- EPA Shaughnessy Code: 128859
- Year of Initial Registration: 1991
- Pesticide Type: Fungicide
- U.S. and Foreign Producers: U.S. Borax & Chemical Corp.
  3075-Wilshire Blvd.
  Los Angeles, CA 90010

2. USE PATTERNS AND FORMULATIONS

Application sites: Interior uses, such as PVC carpet backing, shower curtains, wall coverings, etc., and exterior uses, such as PVC tenting and awnings, polyolefin wire and cable coverings, etc.

Type of formulation: 100 manufacturing grade formulation.

Types and methods of application: Granular product can be fed into an extruder, calender machine, or injection molding machine for plastics or incorporated during pigment dispersion cycle for coatings.

Application rates: The effective additive level varies depending on fungal susceptibility of the product and ultimate conditions for the use of the product. For protection of plastics, a rate range of 3-30 parts product per hundred parts resin is used. For coatings, rates range from 1.25 to 3.0 lb/gal.

3. SCIENCE FINDINGS

Summary Science Statement

The toxicological data submitted for this active ingredient included the full complement of acute studies. Results of these studies show that zinc borate is in the toxicity category III (CAUTION) based on acute dermal and primary eye irritation studies with rabbits.

Zinc borate did not induce either genotoxic effects or chromosomal aberrations in mutagenicity studies.

Environmental fate data were waived because there is no direct or indirect discharge resulting from production of this chemical.

Chemical Characteristics

Color: White
Physical State: Granular
Melting Point: Greater than 550 degrees C
Particle Size: 8-20 um (mean)
Density: 40 to 50 lbs/cu. ft. (bulk)
pH: 7.6 (In deionized H_2O)

Toxicological Characteristics

Acute effects:

1. Acute Oral (LD50) in Rats - The LD50 in rats (males) was found to be greater than 10 g/kg. Zinc borate did not produce severe signs of toxicity in treated rats.
2. Acute Dermal Toxicity (LD50) in Rabbits - The LD50 was estimated to be greater than 10 g/kg in both male and female albino rabbits.
3. Primary Eye Irritation in Albino Rabbits - Zinc borate was shown to be an eye irritant producing mild conjunctivitis in albino rabbits.
4. Primary Dermal Irritation/Corrosivity in Albino Rabbits - The Primary Irritation Index of zinc borate in rabbits was found to be 0. Therefore, it is not considered to be an irritant or corrosive.

Data from acute oral and acute dermal toxicity tests place the chemical in Toxicity Categories IV and III, respectively. These results were duplicated in the primary eye and primary dermal irritation studies. In a dermal sensitization study involving guinea pigs, zinc borate showed no evidence of adverse dermal effects. Precautionary labeling language as follows is required for this product:

"Avoid skin and eye contact. Avoid inhalation. Wash after handling."

Mutagenic effects:

In the Salmonella/microsomal Assay (Ames Bioassay) for bacterial mutagenic activity, zinc borate did not elicit any mutagenic response in Salmonella tester strains when tested either with or without a metabolic activation system.

Environmental Fate

The Agency reviewed available data on fate and transport of zinc and boron in the environment and concluded that no additional data were warranted for the proposed pesticidal use. The following were among factors contributing to this position:

1. According to the registrant, there is no direct or indirect discharge of zinc borate into the environment from manufacturing this chemical.
2. The water solubility for zinc borate at 23 degrees C (average temperature

under natural conditions) is very low (0.1 at pH 5 and 7, and 0.03 at pH 9). The zinc borate will be incorporated into some synthetic matrix to act as an antifungal agent. To be effective over time, the chemical must not have a propensity to solubilize and leach out of the matrix. Any movement of the chemical out of the matrix will either be by abrasion (wear) or leaching as solubilized ions. Therefore it is highly unlikely that large amounts of the chemical will get into the the environment through its pesticidal use. Leaching studies are being required to confirm that ion levels in the leachate would be of no toxicological concern.

3. When reformulated into other products where it serves as a fire retardant and fungicide , i.e. in PVC products, ceramics, other chemicals, cosmetics, etc., zinc borate becomes chemically incorporated into the finished products and loses its identity.
4. The chemical reactions of zinc borate can form a composite of oxides of zinc and boron. Both these chemicals occur naturally in soil and are essential micronutrients for plants. Moreover, both zinc and boron are used extensively in agriculture as soil amendments to improve the vigor of plants. As soil amendments these chemicals are applied at levels substantially higher than would be anticipated from their use in plastics as a fungicide. The Agency is unaware of any lasting adverse effects on the environment from the soil amendment uses of zinc and boron. The Agency concluded that additional data requirements would not add any substantive information to the available scientific data base.

Based on these facts, the registrant was granted a waiver from all environmental fate data requirements including hydrolysis data.

Ecological Characteristics

In avian dietary studies, the LC50 value of zinc borate in the mallard ducklings (Anas platyrhynchos) is estimated to be greater than 5,620 ppm. No mortality occurred in either the control or treated groups. A slight reduction in body weight was observed at the 6,520 ppm concentration during the exposure period. There was no effect on feed consumption at any concentration tested.

The acute toxicity of zinc borate to bluegill sunfish (Lepomis macrochirus) was tested under static conditions at mean concentrations of 94, 137, 182, 248, and 335 ppm. The 96hr LC50 for bluegill sunfish was shown to be greater than 335 ppm. These results indicate that zinc borate is practically nontoxic to the fish species tested.

Benefits

Potential advantages to the general public appear to exist by having Firebrake ZB available as a fungicide in view of the following:

- Zinc borate has a relatively low toxicity with no demonstrated adverse public health effects following extensive long-term use as a fire retardant in applications including carpet backing, fabric coating, wall covering, urethane foam, roofing PVC tenting and awnings, etc.

- Zinc borate is a broad-spectrum fungicide with no demonstrated adverse environmental effects. This chemical would provide protection of a variety of plastic products and may decrease the environmental burden of more toxic pesticides by acting as an alternative for protection of plastics.

Tolerance Assessment

There are no proposed direct food or feed uses of zinc borate, therefore, EPA has not established tolerances or exemptions from tolerances in raw agricultural commodities or processed food and feed products under the Federal Food, Drug and Cosmetic Act (FFDCA).

4. SUMMARY OF MAJOR DATA GAPS

A leachability study is being required as a condition of registration. This study must be submitted within nine (9) months of registration approval of Firebrake ZB

Expiration Date

Conditional registration of Firebrake ZB will expire on July 31, 1992.

5. CONTACT PERSON AT EPA

Susan T. Lewis
Product Manager (21)
Fungicide-Herbicide Branch
Registration Division (H7505C)
Environmental Protection Agency
401 M St., S.W.
Washington, D.C. 20460

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For more information relative to pesticides and their use, please contact the PMEP staff at:

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Cornell University
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Cornell University

Borates: Handbook of Deposits, Processing, Properties, and Use

Garrett

Table [illegible] (continued)

Name (Group, form)	Formula	Molecular weight; % B_2O_3; hardness; density; crystal system
25. Boracite (= Stassfurtite) a. Low temp. β b. High temp. α	$Mg_3[B_3O_5]_2[BO_3]Cl$ $5MgO \cdot MgCl_2 \cdot 7B_2O_3$ $Mg_3B_7O_{13}Cl$	392.04; 62.16%; 7–7.5; 2.90–2.97; β orthorhombic, α cubic (>265°C)
26. Borax (= Tincal)	$Na_2[B_4O_5(OH)_4] \cdot 8H_2O$ $Na_2O \cdot 2B_2O_3 \cdot 10H_2O$ $Na_2B_4O_7 \cdot 10H_2O$	381.37; 36.51%; 2–2.5; 1.711–1.715; monoclinic
27. Borcarite	$Ca_4Mg(CO_3)_2[B_4O_6(OH)_6]$ [illegible] [illegible]	548.92; 25.51%; 4; 2.77–2.79; monoclinic
28. Boromuscovite 29. (1M, 2M) (Mica)	$KAl_2Si_3BO_{10}(OH,F)_2$ End Member: [illegible]	384.13; 9.06%; [illegible] 382.14; 9.11%; monoclinic
30. Braitschite	$12B_2O_3 \cdot 6(Ca,Na_2)O \cdot (RE)_2O_3 \cdot 6H_2O$ [illegible]	(typical 48.2%); [illegible]; 2.84–2.90; hexagonal
31. Braitschite (Ce)	[illegible]	1632.15; 46.92%; rhombohedral
32. Braunite, boron	[illegible]	587.37; 5.93%
33. Buergerite (Tourmaline)	[illegible] End Member: [illegible]	1052.35; 9.92%; 7; 3.29–3.31; rhombohedral
34. Cahnite	$Ca_2[B(OH)_4]AsO_4$ [illegible] [illegible]	297.02; 11.68%; 3; 3.06–3.16; tetragonal
35. Calciborite	$Ca[B_2O_4]$ $CaO \cdot B_2O_3$ CaB_2O_4	125.70; 55.39%; 3.5; 2.88; orthorhombic
36. [illegible]	[illegible]	358.06; 13.47%; [illegible]; 2.30; monoclinic
37. *Cappelenite-(Y)*	$(Ba,Ca,Ce)(Y,Ce,La)_6(BO_3)_6Si_3O_9F_2$ End Member: $BaY_6B_6Si_3O_{24}F_2$	1395.49; 14.97% (typical 16.9–17.2%); [illegible]; 4.41; hexagonal (rhombohedral?) 1241.87; 16.82%
38. Carboborite	$MgCa_2(CO_3)_2[B(OH)_4]_2 \cdot 4H_2O$ [illegible] [illegible]	454.22; 15.32%; [illegible]
39. Caryocerite	[illegible]	(typical 1.50–4.30%); [illegible]
40. Chambersite (Boracite)	[illegible] [illegible] [illegible]	485.91; 50.25%; [illegible]
41. Charlesite (Ettringite)	[illegible] End Member: [illegible]	[illegible]
42. Chelkarite	[illegible]	[illegible]; orthorhombic
43. Chestermanite (Ludwigite)	[illegible] End Member: [illegible]	[illegible]; 17.7% 195.27; 17.8%; orthorhombic
44. Chlorite, boron bearing (e.g., Manandonite, 2H2)	[illegible] [illegible] End Member: [illegible]	[illegible]; (triclinic) [illegible]
45. Chromdravite (Tourmaline)	[illegible] End Member: [illegible]	[illegible]
46. [illegible]	[illegible] End Member: [illegible]	[illegible]; monoclinic
47. Colemanite (= Borocalcite)	$Ca[B_3O_4(OH)_3] \cdot H_2O$ [illegible] [illegible]	[illegible]
48. Congolite (Boracite) [illegible]	[illegible]	[illegible]

Borates: Handbook of Deposits, Processing, Properties, and Use

Garrett

Table 1.1 (*continued*)

Name (Group: form)	Formula	Molecular weight; % B_2O_3; hardness; density; crystal system
25. Boracite (= Stassfurite) a. Low temp., β b. High temp., α	$Mg_3[B_3O_5]_2[BO_3]Cl$ $5MgO{\cdot}MgCl_2{\cdot}7B_2O_3$ $Mg_3B_7O_{13}Cl$	392.04; 62.16%; 7–7.5; 2.89–2.97; β orthorhombic, α cubic (>265°C)
26. Borax (= Tincal)	$Na_2[B_4O_5(OH)_4]{\cdot}8H_2O$ $Na_2O{\cdot}2B_2O_3{\cdot}10H_2O$ $Na_2B_4O_7{\cdot}10H_2O$	381.372; 36.510%; 2–2.5; 1.711–1.715; monoclinic
27. Borcarite	$Ca_4Mg(CO_3)_2[B_4O_6(OH)_6]$ $4CaO{\cdot}MgO{\cdot}2CO_2{\cdot}2B_2O_3{\cdot}3H_2O$ $Ca_4Mg(CO_3)_2B_4O_7{\cdot}3H_2O$	545.92; 25.51%; 5; 2.77–2.79; monoclinic
28. Boromuscovite	$KAl_2Si_3BO_{10}(OH, F)_2$	384.13; 9.06%; —; 2.13–2.90
29. 1M, 2M[1] (Mica)	End Member, $KAl_2Si_3BO_{10}(OH)_2$	282.14; 9.11%; monoclinic
30. Braitschite	$12B_2O_3{\cdot}6(Na_2O, CaO{\cdot}RE_2O_3){\cdot}6H_2O$ $(Ca, Na_2)_7RE_2B_{22}O_{43}{\cdot}6H_2O$	[illegible] typical 48.2%; —; 2.84–2.90; hexagonal
31. Braitschite-Ce[c]	$(Ca, Na_2)_7(Ce, La)_2B_{22}O_{43}{\cdot}7H_2O$	1632.15; 46.92%; rhombohedral
32. Braunite, boron	$Mn_7O_8SiO_4$; $Mn_7O_8BO_3$	587.37; 5.93%
33. Buergerite (Tourmaline)	$NaFe^{3+}_3Al_6O_3(OH, F)_3[BO_3]_3Si_6O_{18}$ End Member, $NaFe^{3+}_3Al_6B_3Si_6O_{30}F$	1052.35; 9.92%; 7–8; 3.29–3.34; rhombohedral
34. Cahnite	$Ca_2[B(OH)_4]AsO_4$ $4CaO{\cdot}B_2O_3{\cdot}As_2O_5{\cdot}4H_2O$ $Ca_2BAsO_6{\cdot}2H_2O$	297.92; 11.68%; 3; 3.06–3.18; tetragonal
35. Calciborite	$Ca[BO_2{\cdot}BO]$ $CaO{\cdot}B_2O_3$ CaB_2O_4	125.70; 55.39%; 3.5; 2.88; orthorhombic
36. Canavesite	$Mg_2[B_2O_5](CO_3){\cdot}H_2O$ [illegible]	258.00; 13.47%; —; 2.00; monoclinic
37. Cappelenite-(Y)[c]	$(Ba, Ca, Ce)_2(Y, Ce, La)_6[(BO_3)_6Si_3O_9]$; $Ba(Ce, Y)_6B_6Si_3O_{24}F_2$[c] End Member, $BaY_6B_6Si_3O_{24}F_2$	1395.49; 14.97% (typical 16.9–17.2%); 6–6.5; 4.31; hexagonal (rhombohedral ?)[c] 1241.87; 16.82%
38. Carboborite	$MgCa_2(CO_3)_2[B(OH)_4]_2{\cdot}4H_2O$ $2CaCO_3{\cdot}MgO{\cdot}B_2O_3{\cdot}8H_2O$ $Ca_2Mg(CO_3)_2B_2O_4{\cdot}8H_2O$	454.22; 15.33%; 2; 2.00–2.12; monoclinic
39. Caryocerite[c]	$(Ca, Na)_3(RE, Th, Ce)_2[(Si, B)O_4]_3F_2{\cdot}5H_2O$	(typical 1.50–4.70%); 4.5–6; 4.13–4.45; hexagonal
40. Chambersite (Boracite)	$Mn_3[B_3O_5]_2[BO_3]Cl$ $5MnO{\cdot}MnCl_2{\cdot}7B_2O_3$ $Mn_3B_7O_{13}Cl$	483.94; 50.35%; 7; 3.47–3.49; orthorhombic
41. Charlesite[d] (Ettringite)	$Ca_6(Al, Si)_2(SO_4)_2B(OH)_4(O, OH)_{12}{\cdot}26H_2O$; End Member, $Ca_6Al_2SB_2O_6(OH)_{12}{\cdot}26H_2O$	1164.91; 2.99%; —; 1.6[illegible] 1250.28; 2.81%; rhombohedral
42. Chelkarite	$CaMg[B_2O_4]Cl_2{\cdot}7H_2O$	347.01; 20.06%; —; 2.9[illegible]; orthorhombic
43. Chestermanite[c] (Ludwigite)	$Mg_2(Fe^{3+}, Mg, Al, Sb^{5+})O_2[BO_3]$ End Member, $Mg_2Fe^{3+}BO_5$	196.64; 17.70%; —; 3.76–3.8[illegible] 195.27; 17.83%; orthorhombic
44. Chlorite, boron bearing (cf., Manandonite 2H-4)[c]	$Li_2Al_4[AlBSi_2O_{10}](OH)_8$ $Li_{1.4}Al_{4.2}B_{1.0}Si_{2.0}O_{10}(OH)_8$[c] End Member, $Li_2Al_5BSi_2O_{10}{\cdot}4H_2O$	511.82; 6.80%; —; 2.83–2.89; monoclinic (triclinic) 501.88; 6.31%
45. Chromdravite[d] (Tourmaline)	$NaMg_3(Cr, Fe^{3+})_6[BO_3]_3[Si_6O_{18}](OH)_4$ End Member, $NaMg_3Cr_6B_3Si_6O_{27}(OH)_4$	1120.39; 9.32%; —; 3.4[illegible] 1105.84; 9.45%; rhombohedral
46. Clinokurchatovite[d] (cf., kurchatovite)	$Ca(Fe^{2+}, Mg, Mn)B_2O_5$ End Member, $CaMgB_2O_5$	186.73; 37.28%; —; 3.0[illegible]–3.[illegible] 166.00; 41.94%; monoclinic
47. Colemanite (= Borocalcite)	$Ca[B_3O_4(OH)_3]{\cdot}H_2O$ $2CaO{\cdot}3B_2O_3{\cdot}5H_2O$ $Ca_2B_6O_{11}{\cdot}5H_2O$	411.09; 50.81%; 4.5; 2.42–2.4[illegible]; monoclinic
48. Congolite (Boracite) (cf., ericaite)	$(Fe^{2+}, Mg, Mn)_3[B_3O_5]_2[BO_3]Cl$ $(Fe, Mg, Mn)_3B_7O_{13}Cl$ [illegible]	454.21; 53.65%; 7.5; 3.57–3.58; rhombohedral [illegible]

Sheepscot
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SHEEPSCOT MACHINE WORKS

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Fillers are various inert materials that are added to resins for the purposes of cost reduction, modifying mechanical properties or enhancing thermal transfer. They may be organic or metallic in nature. Their relative hardness (or abrasivity) is considered in the design and configuration of all Sheepscot meter/mix and dispense systems as it pertains to the long term durability and reliability of wetted components. A range of materials are available to optimize each system for the application.

Moh's Hardness Scale. Named after Fredrich Mohs, a German mineralogist who introduced the scale in 1812. Hardness, in general, is determined by what is known as Mohs's scale, a standard which is mainly applied to non-metallic elements and minerals. In this scale, there are ten degrees or steps, each designated by a mineral, the difference in hardness of the different steps being determined by the fact that any member in the series will scratch any of the preceding members. The scale is as follows:

1	Talc
2	Gypsum
3	Calcite
4	Fluor spar
5	Apatite
6	Orthoclase
7	Quartz
8	Topaz
9	Sapphire
10	Diamond

Following are commonly used fillers and their Moh's numbers:

Filler	Moh's
Talc	1
Calcium Carbonate (aka Limestone)	3
Aluminum Tri-Hydrate. (aka Hydrated Alumina)	4
Zinc Borate	4
Silica (aka Silicone Dioxide, Crystalline quartz)	7
Aluminum Oxide	9

Notes:

Talc and Calcium Carbonate are commonly used as extenders in resins and are considered to be non-abrasive.

Zinc Borate is used as a flame retardant to qualify for UL 94V-O rating. It is considered to be slightly abrasive.

Silica and Aluminum Oxide are often used to provide enhanced mechanical and/or thermal properties. They are considered to be highly abrasive.

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